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ABSTRACT

This booklet contains an overview and a sample of some of the curricular materials developed in Jefferson County's Systematic Teaching and Measuring Mathematics (STAMM) program. It provides continuous progress in mathematics, K-12, using management by objectives. Well-defined processes for diagnosis, instructional activities, and assessment are indicated, with hints on the need for careful record-keeping. Achievement on both standardized and criterion-referenced tests has consistently improved since the implementation of the program. Teacher resource packets, guides, and a sampler kit are available for purchase. (MS)

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ED144843

Systematic Teaching And Measuring Mathematics

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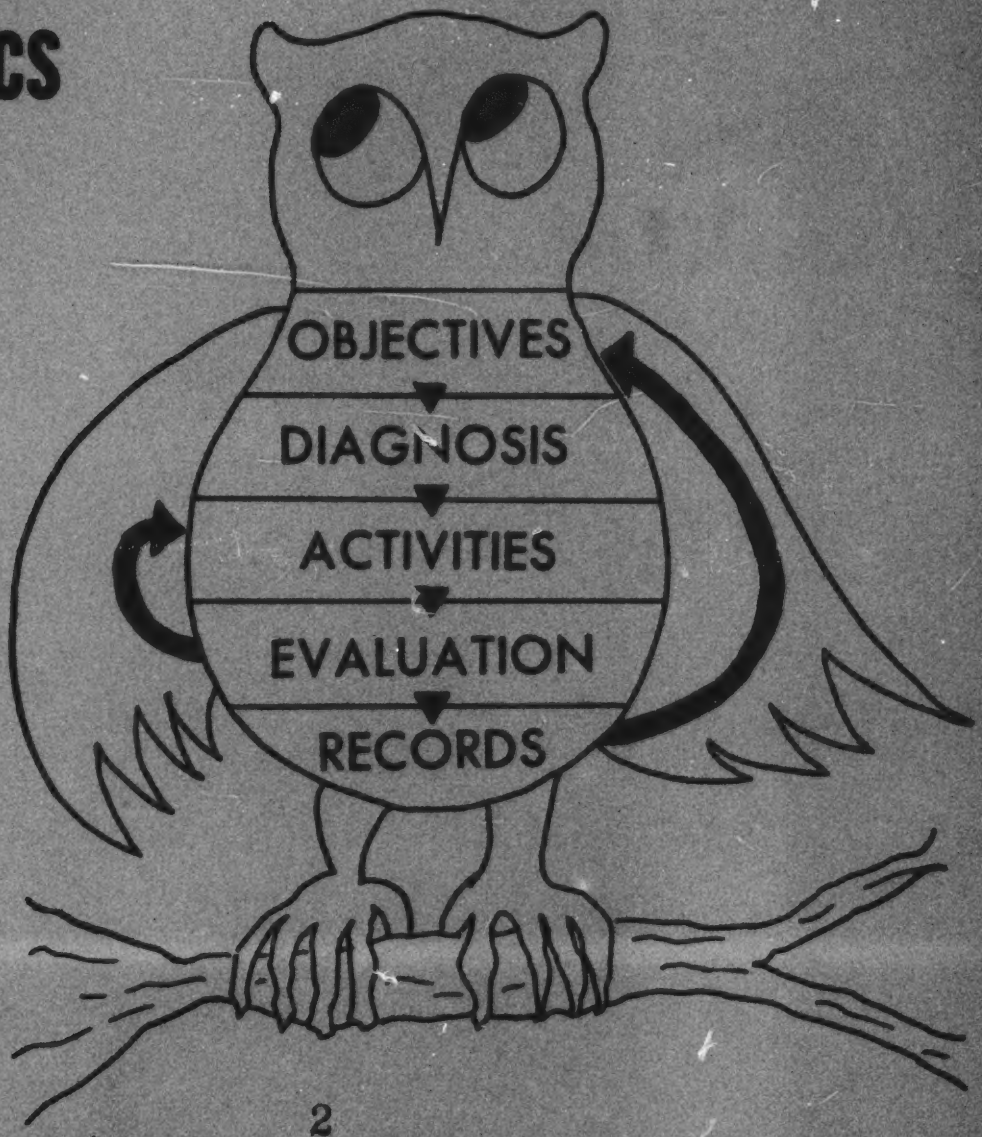

MINI-SAMPLER

SE 023 228

This booklet contains an overview and a sample of some of the materials available in Jefferson County's STAMM program. Materials are being made available to school districts at a nominal cost through grants from the Department of Health, Education, and Welfare and the Colorado Department of Education. The program has been validated as a national model by the United States Office of Education and the National Institute of Education. Additional information can be obtained from:

Project STAMM
Mathematics Department
1209 Quail Street
Lakewood, Colorado

(303) 234-7000 ext. 342

Glyn H. Sharpe
Director

Cathy Seeley Peavler
Project Specialist

Larry D. Bradsby
Assistant Director

Randy V. Abbott
Project Specialist

Nikki Jones
Project Associate

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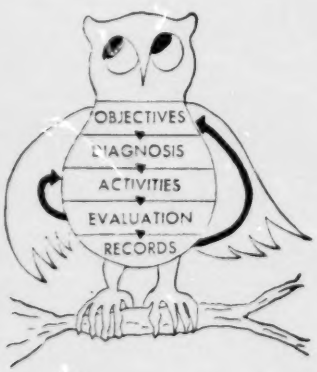
OVERVIEW

STAMM is a complete mathematics program for kindergarten through high school. Each level is organized around a set of performance objectives. Over the past seven years Jefferson County teachers have developed a teaching resource packet for each objective, organized into eight instructional clusters per level. Teaching guides are available with additional information for primary, intermediate, secondary, applied math, rapid calculation, and mathematics competencies.

STAMM is based on the concept of continuous progress. It is, therefore, important for a school using STAMM to keep complete records on each student and to test each student's progress frequently. This enables a teacher in the fall to continue a student from where he/she left off in the spring. A teacher with one grade level of students may need to be familiar with more than one level of the program to accommodate continuous progress.

The STAMM program offers a management system. That is, it offers a way to organize the teaching of mathematics so that each student can be successful and challenged. It does not, however, dictate any particular teaching style. Teachers have successfully used STAMM in nearly every kind of classroom structure, including self-contained, teamed, departmentalized, small group, large group, or individualized instruction.

Since STAMM has been in use in Jefferson County, CTBS test scores in sixth and eighth graders have shown a marked upswing, as shown on the following pages. Regardless of other possible factors, the increases certainly have been sparked by the commitment on the part of Jefferson County teachers, administrators, and Board of Education toward a systematic, objective oriented, continuous progress approach toward the teaching of mathematics, through the use of the STAMM program.

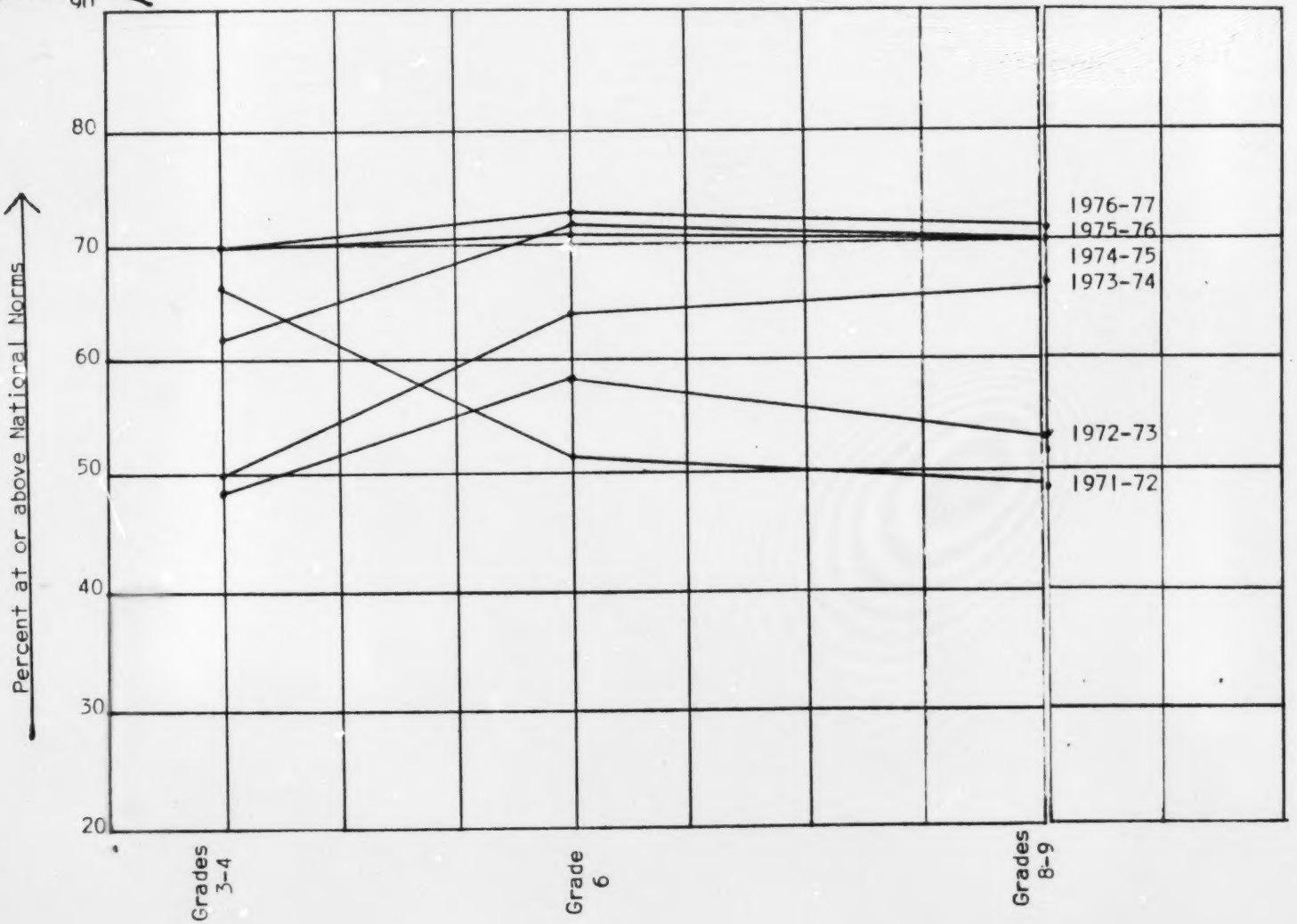


TEST SCORES

	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77
Grades 3-4	67%	48%	50%	62%	70%	70%
Grade 6	52%	58%	64%	72%	71%	73%
Grades 8-9	48%	52%	67%	70%	70%	71%

(Cont.)

TRENDS In MATHEMATICS (CTBS tests) Jefferson County Schools



MODEL

OBJECTIVES
What pupils can and should do
(Math Guides)

↓

DIAGNOSIS
Pupil needs
(Records, Placement Tests, Resource Packets)

↓

ACTIVITIES
Designed for pupil needs
(Resource Packets)

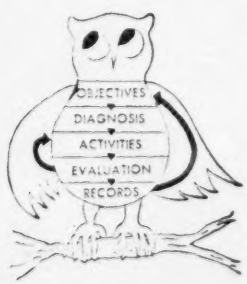
↓

EVALUATION
Pupil Performance
(Resource Packets, Criterion Tests)

↓

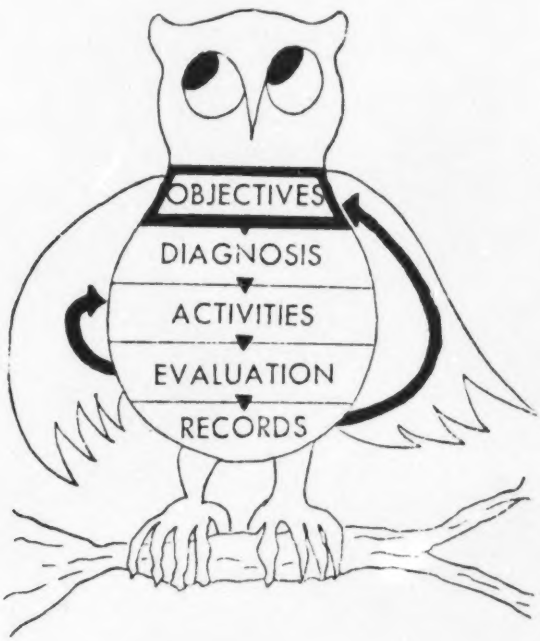
RECORDS
Pupil information
(Class Record Chart, Individual Student Records)

recycle



OBJECTIVES

The performance objectives for the STAMM program cover the following topics: numbers and numeration, properties and operations on numbers, computation, sets and logic, equations and inequalities, relations and functions, probability and statistics, graphing, geometry, measurement, mathematical systems, and consumer mathematics. Levels A, B, C, D, E, F, GE, G, and H represent the continuous progress portion of the program for grades K - 8. Each of these levels consists of a set of performance objectives grouped into eight teaching clusters. A set of 39 mathematics competencies is tested at the end of grade eight and students who show a deficiency can take a course in competencies. Objectives for high school have been developed for Algebra I , Geometry, Algebra II, Trigonometry, Applied Math, Rapid Calculation, and Vocational Math. A list of competencies is given on the next page, and a complete list of objectives is available with the purchase of the sampler kit or the appropriate level guide (see price list).



STAMM PROGRAM MATHEMATICS COMPETENCIES

(Systematic Teaching And Measuring Mathematics)

For full participation in society and to be a productive enlightened citizen, the Jefferson County graduate should have the following competencies:

Comp. 1: Apply nonstandard measures

Comp. 2: Number value and place value

Comp. 3: Equivalent fractions

Comp. 4: Compute perimeters of polygons

Comp. 5: Change fractions to decimals

Comp. 6: Solve simple linear sentences

Comp. 7: Test validity of statements

Comp. 8: Solve problems with whole numbers

Comp. 9: Similar and congruent triangles

Comp. 10: Estimate the real cost of an article

Comp. 11: Determine interest when installment buying

Comp. 12: Translate math sentences to English

Comp. 13: Determine mean, median, and mode

Comp. 14: Maintain personal bank records

Comp. 15: Estimate results of a verbal problem

Comp. 16: Obtain information from graphs

Comp. 17: Recognize kinds of lines

Comp. 18: Express numbers as decimals or percents

Comp. 19: Use inequalities to indicate comparisons between two quantities

Comp. 20: Use standard measuring devices

Comp. 21: Problems involving percent

Comp. 22: Determine real sizes from scale drawings

Comp. 23: Construct scale drawings

Comp. 24: Use ratio and proportion

Comp. 25: Read maps

Comp. 26: Round off measurements

Comp. 27: Rules and Principles of arithmetic operations

Comp. 28: Write math sentences from verbal problems

Comp. 29: Find misuse of statistics

Comp. 30: Estimate probability

Comp. 31: Problems involving fractions

Comp. 32: Change Roman numerals to conventional numbers

Comp. 33: Use standard measures

Comp. 34: Compute areas of polygons

Comp. 35: Plan a budget

Comp. 36: Construct linear, bar, and circle graphs

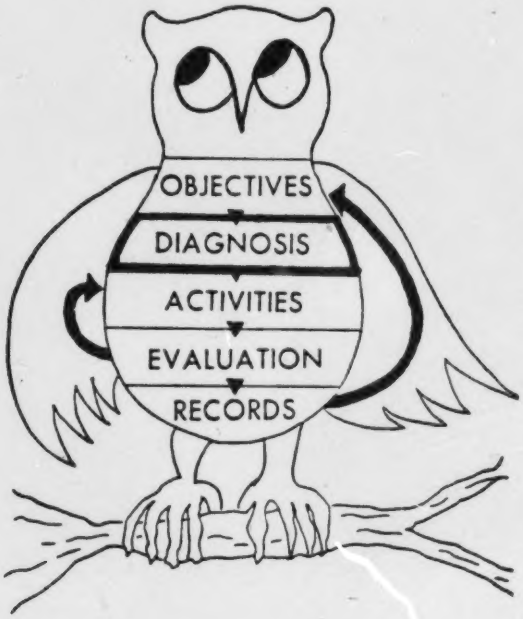
Comp. 37: Know multiplication facts through 12 X 12

Comp. 38: Arithmetic algorithms for fractions

Comp. 39: Recognize simple plane figures

DIAGNOSIS

Initial placement on the STAMM continuum can be facilitated by use of the placement test (Levels D - H). After a student has had experience in the program, placement each year will be based on records. To facilitate grouping in the classroom a teacher may wish to administer the pre-test from the teacher's resource packet (see page 9).



ACTIVITIES

For each objective and competency in the STAMM program, a teacher's resource packet has been developed. This includes a pre- and post-test, page references for several textbooks, teaching notes where appropriate, worksheets, activities, and games, whenever possible. These packets are intended for use by teachers rather than students, and can provide options for teachers in planning. Codings for textbooks other than those listed are also available on request. A sample resource packet follows.

OBJECTIVE: PUPILS CAN DESCRIBE MANY NAMES FOR THE SAME NUMBER (0-9999).

THESE RESOURCE PACKETS WERE PREPARED IN
COOPERATION WITH JEFFERSON COUNTY TEACHERS.
THIS PACKET WAS COORDINATED AND PREPARED BY:

LINDA ANDERSON

UNDER THE DIRECTION OF:

GLYN H. SHARPE, COORDINATOR OF MATHEMATICS
LARRY D. BRADSBY, MATHEMATICS RESOURCE SPECIALIST
FRED A. LEES, MATHEMATICS RESOURCE TEACHER

BOOK PAGES: HOLT, RINEHART & WINSTON (1970): pp. 6-9, 14, 17, 20, 21, 205, 206, 345

ADDISON-WESLEY (1973): p. 31

HOUGHTON MIFFLIN (1972): pp. 4, 7, 8, 16, 21, 24

PREVIOUS OBJECTIVES: B-12, C-8

FOLLOWING OBJECTIVES: E-2

ESSENTIAL MATERIALS: RODS

GAMES: NUMBER CARD GAME, NUMBER CONTEST

PRE-TEST

1. WRITE 3 OTHER NAMES FOR 515.

_____

_____

_____

2. MATCH THE NUMBER TO ANOTHER NAME FOR IT.

213	9,000 + 100 + 70 + 8
4,175	200 + 40 + 6
220	4,000 + 100 + 70 + 5
9,178	211 + 2
199	225 - 5
246	200 - 1

POST-TEST

1. WRITE EACH NUMBER IN THREE OTHER WAYS.

1. 619 _____ _____ _____

2. 2479 _____ _____ _____

2. MATCH THE NUMBER TO ANOTHER NAME FOR IT.

37	3,000 + 400 + 70 + 6
3,476	130 + 25
145	9,000 + 137
486	40 - 3
9,137	115 + 30
155	490 - 4

PRE-TEST ANSWERS

1. ANSWERS WILL VARY

SOME EXAMPLES ARE:

500 + 10 + 5

500 + 15

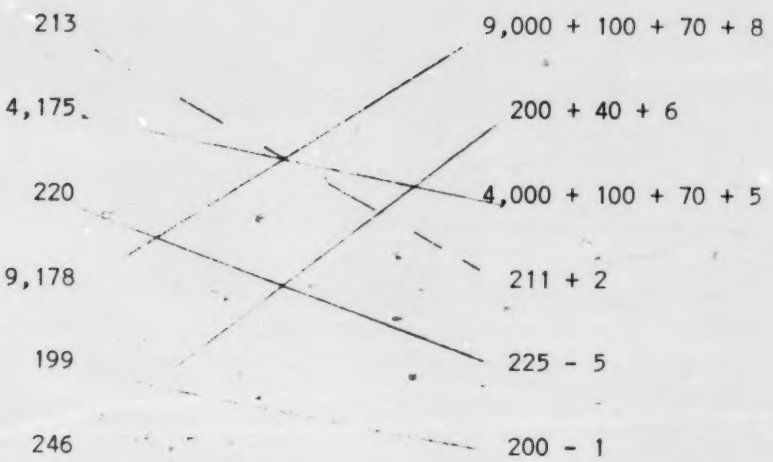
520 - 5

514 + 1

513 + 2

525 - 10

2.



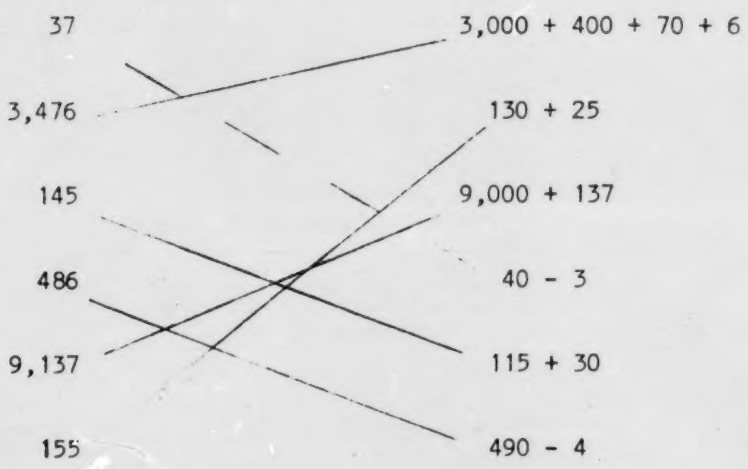
POST-TEST ANSWERS

1. ANSWERS WILL VARY.

   THESE ARE EXAMPLES OF EACH:

   1. 600 + 19 620 - 1 617 + 2
   2. 2,000 + 400 + 70 + 9 2,480 - 1 2,478 + 1

2.



ACTIVITIES

1. NUMBER BOOK

DIRECTIONS: CONSTRUCT NUMBER BOOKLETS FOR GIVEN NUMBERS. USE AS MANY NAMES AS YOU CAN.

2. CUISENAIRE RODS

DIRECTIONS: HAVE CHILDREN USE A YELLOW ROD - 5 - AND MAKE ALL OTHER POSSIBLE NAMES FOR THE 5.

YELLOW	
PURPLE	WH.
L. GREEN	RED
RED	L. GREEN
WH.	PURPLE

SOME NAMES FOR 5

5

4 + 1

3 + 2

2 + 3

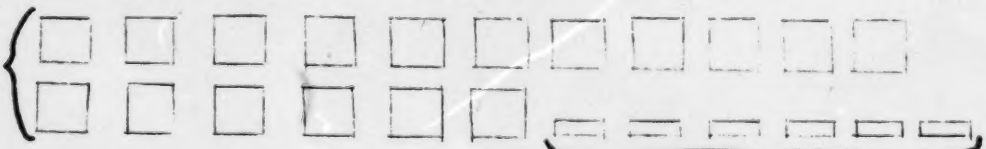
1 + 4

WHEN THIS IS DONE, THE NAMES SHOULD BE WRITTEN WITH NUMERALS ON THE BOARD OR ON PAPER. HAVE THE CHILDREN MODEL LARGE NUMBERS THROUGH 9,999., e.g., 1,760.

SOME SAMPLE MODELS THAT THE CHILDREN MAY MAKE ARE:

17

10X10 CM GRID CARDS



6 ORANGE REDS

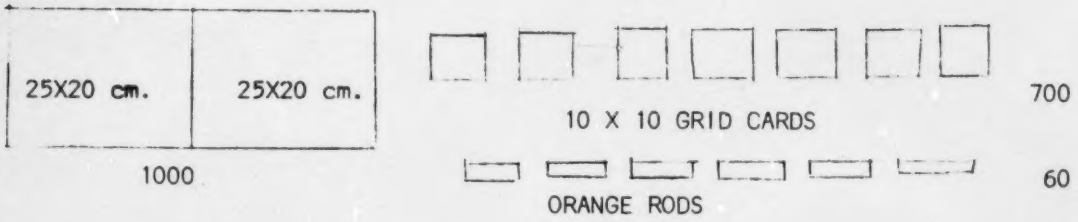
1700

60

(CONTINUED ON NEXT PAGE)

ACTIVITIES (continued)

2. CUISENAIRE RODS (continued)



GAMES

1. NUMBER CARD GAME

DIRECTIONS: MAKE A DECK OF CARDS WITH EACH CARD PORTRAYING A NUMBER (SUCH AS "14-7"). THERE WOULD BE PAIRS OF ANSWERS THAT WOULD MATCH (e.g., THE MATCHING CARD TO "14-7" COULD BE "4+3"). THEN THERE WOULD BE ONE CARD WHICH WOULD BE THE "0" CARD WHICH WOULD HAVE NO MATCH. RULES FOR THE GAME WOULD BE THE SAME AS IN "OLD MAID." THE PLAYER ENDING UP WITH THE "0" WOULD BE THE WINNER.

2. NUMBER CONTEST

DIRECTIONS: HOLD A CONTEST IN WHICH EACH CONTESTANT WOULD BE GIVEN A NUMBER. EACH CONTESTANT WOULD WRITE AS MANY NAMES FOR THIS NUMBER AS POSSIBLE IN A GIVEN AMOUNT OF TIME.

1. WORKSHEET

RENAMING

WRITE TWO NAMES FOR EACH NUMBER.

1.	143	(150 - 7)	(120 + 23)
2.	99		
3.	26		
4.	80		
5.	2		
6.	39		
7.	240		
8.	108		
9.	216		
10.	450		
11.	100		
12.	504		
13.	629		
14.	401		
15.	719		
16.	432		
17.	98		
18.	101		
19.	707		
20.	999		

2. WORKSHEET

RENAMING THOUSANDS

WRITE TWO NAMES FOR EACH NUMBER.

1. 1432 _____ _____
2. 2500 _____ _____
3. 4999 _____ _____
4. 7001 _____ _____
5. 2010 _____ _____
6. 5555 _____ _____
7. 7068 _____ _____ _____
8. 9099 _____ _____
9. 4071 _____ _____
10. 2342 _____ _____
11. 6791 _____ _____
12. 3987 _____ _____
13. 2634 _____ _____
14. 8147 _____ _____
15. 2946 _____ _____

3. WORKSHEET

RENAMING NUMBERS

A. $4 + 3 = 6 +$ _____

B. $3 +$ _____ $= 2 + 8$

C. $4 + 1 =$ _____ $+ 3$

D. $7 + 1 = 10 -$ _____

E. $6 - 2 = 3 +$ _____

F. $8 - 2 = 3 +$ _____

G. $6 - 4 = 8 -$ _____

H. $5 + 3 = 9 -$ _____

I. $4 + 6 = 5 +$ _____

J. $5 + 4 = 7 +$ _____

K. $5 + 8 = 7 +$ _____

L. $6 +$ _____ $= 10 + 2$

M. $3 +$ _____ $= 12 - 6$

N. $4 + 1 =$ _____ $- 5$

O. $5 + 3 =$ _____ $+ 7$

P. $7 + 5 = 8 +$ _____

Q. $6 -$ _____ $= 2 + 2$

R. $5 + 5 =$ _____ $- 10$

S. $3 + 6 = 8 +$ _____

T. $12 - 6 = 3 +$ _____

3. WORKSHEET ANSWERS

A. 1

B. 7

C. 2

D. 2

E. 1

F. 3

G. 6

H. 1

I. 5

J. 2

K. 6

L. 6

M. 3

N. 10

O. 1

P. 4

Q. 2

R. 20

S. 1

T. 3

1. ENRICHMENT WORKSHEET

RENAMING WITH "X" AND "-"

WRITE TWO NAMES FOR EACH NUMBER. USE MULTIPLICATION AND DIVISION ONLY.

1. 8 = 2 X 4 OR 16 ÷ 2
2. 10 = _____ OR _____
3. 25 = 5 X 5 OR _____
4. 35 = _____ OR _____
5. 12 = 3 X 4 OR 2 X 6
6. 18 = _____ OR _____
7. 21 = _____ OR _____
8. 56 = _____ OR _____
9. 6 = _____ OR _____
10. 72 = _____ OR _____
11. 48 = _____ OR _____
12. 24 = _____ OR _____
13. 16 = _____ OR _____
14. 28 = _____ OR _____
15. 100 = _____ OR _____

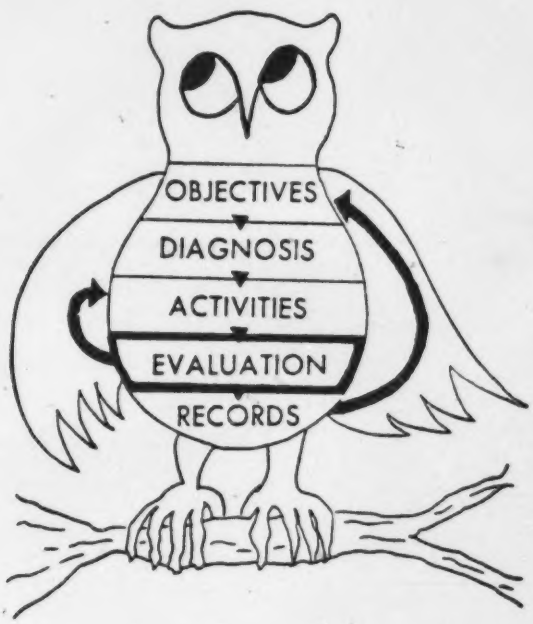
1. ENRICHMENT WORKSHEET ANSWERS

USE ONLY MULTIPLICATION IF THE DIVISION IS TOO DIFFICULT.

1.	2 X 4	DIVISION CAN VARY 16 ÷ 2
2.	2 X 5, 1 X 10	100 ÷ 10, 20 ÷ 2
3.	5 X 5, 1 X 25	50 ÷ 2, 100 ÷ 4
4.	5 X 7, 1 X 35	70 ÷ 2, 350 ÷ 10
5.	3 X 4, 2 X 6	
6.	2 X 9, 3 X 6, 1 X 28	36 ÷ 2, 72 ÷ 4
7.	3 X 7, 21 X 1	42 ÷ 2, 210 ÷ 10
8.	7 X 8, 56 X 1, 2 X 28, 4 X 14	112 ÷ 2, 168 ÷ 3
9.	2 X 3, 1 X 6	12 ÷ 2, 18 ÷ 3
10.	72 X 1, 36 X 2, 12 X 6, 4 X 18, 9 X 8, 3 X 24	144 ÷ 2
11.	6 X 8, 48 X 1, 24 X 2, 12 X 4, 3 X 16	96 ÷ 2
12.	24 X 1, 12 X 2, 8 X 3, 4 X 6	48 ÷ 2
13.	16 X 1, 8 X 2, 4 X 4	32 ÷ 2
14.	28 X 1, 7 X 4	56 ÷ 2
15.	100 X 1, 2 X 50, 4 X 25, 10 X 10, 5 X 20	200 ÷ 2

EVALUATION

In addition to the pre- and post-tests found in the teaching resource packets, criterion tests are available for testing clusters of objectives. These consist of multiple choice questions for objectives in levels D through Geometry. A few objectives at each level are not appropriate for multiple choice testing and are left to teacher observation or open-ended questions. At levels A, B, and C, open-ended testing booklets are available. None of these tests are are available in quantity, but individual copies are provided with the purchase of the corresponding level of resource packets. An example of the criterion test items for one objective follows.



Criterion Test

Objective:

D-4 Pupils can describe many names for the same number (0-9999)

1. Choose the answer which is <u>not</u> another name for 9,085.

   A. 9000 + 80 + 5

   B. 90 + 80 + 5

   C. 9,000 + 85

   D. 9,080 + 5

   E. 9,090 - 5

2. Choose the answer that is another name for 762.

   F. 759 + 6

   G. 7 + 6 + 2

   H. 765 - 3

   J. 760 + 3

   K. 775 - 9

3. Choose the answer that is <u>not</u> another name for 626.

   A. 600 + 20 + 6

   B. 629 - 3

   C. 620 + 6

   D. 6 + 2 + 6

   E. 636 - 10

RECORDS

Record keeping is a very important component of any continuous progress program. A teacher needs to keep track of each student's progress throughout the year, and records need to be passed on to teachers year after year.

Warehouse and printing limitations prevent Jefferson County from being able to disseminate quantities of any kind of record keeping form. The following, however, are examples of two kinds of record keeping forms which have been used by Jefferson County teachers. These may provide models for adopting school districts.

STAMM Primary Card
Levels A,B,C,D

Name: _____

A1
- Sets-Collections — A-1
- Size, Length, Weight — A-14
- Larger, Smaller — A-17

A2
- Position — D A-18
- Geometric Figures — A-12
- Spatial Relations — A-13

A3
- Matching — A-2
- Equivalent Sets — D A-3
- Empty Sets — A-4
- More or Less — A-5

A4
- Money Identification — A-22
- Value of Money — A-23

A5
- Cardinal Numbers — A-6
- Denumerating Sets — A-7
- Ordinal Numbers — A-8

A6
- Whole Numbers — A-9
- Counting — A-10
- Numeral Recognition — A-11

A7
- Addition — A-19
- Subtraction — A-20
- Computation — A-21

A8
- Measuring — A-15
- Time — A-16

B1
- Sets- Collections — D B-1
- Matching — M B-2
- Equivalent Sets — D B-3
- Empty Sets — D B-5
- Sub Sets — B-6
- Set Notation — B-7

B2
- Cardinal Numbers — B-8
- One More — B-4
- Order of Numbers — B-10
- Between — B-28
- Position — D B-29
- Graphing — B-32
- Order of Numbers — B-30
- Ordinal Numbers — B-9

B3
- Measuring — B-21
- Liquid Measure — B-22
- Time — D B-23
- Mass — D B-24
- Recording Measure — B-25

B4
- Addition Definition — D B-34
- Subtraction Definition — D B-35
- Inverse Operations — B-31
- Number Line — B-33
- Identify Element — B-38
- Addition Algorithm — B-39

B5
- Geometric Figures — D B-16
- Figure Properties — D B-17
- Constructions — D B-18
- Shapes — B-19
- Spatial Relations — D B-20

B6
- Models of Fractions — B-11
- Names for Numbers — B-12
- Tens and Ones — B-13
- Place Value — B-14
- Expanded Notation — B-15

B7
- Value of Money — D B-26
- Convert Money — B-27

B8
- Addition Facts — D B-36
- Order Property — B-40
- Grouping Property — B-41
- Addition/Subtraction — M B-37

C1
- Collections — M C-1
- Set Equivalence — M C-3
- Subsets — D C-4
- 1-1 Correspondence — M C-2
- Counting Numbers — M C-6

C2
- Plane Figures — M C-32
- Space Figures — — C-33
- Spatial Relations — M C-34

C3
- Place Value — D C-9
- Names for Numbers — D C-8
- Order Relations — D C-29
- Order of Numbers — D C-30
- Expanded Notation — D C-10

C4
- Making Change — D C-41
- Consumer Prices — D C-42
- Definition of Addition — M C-18
- Addition — D C-19
- Def. of Subtraction — M C-20
- Def. of Subtraction — M C-21
- Def. of Subtraction — D C-22
- Commutative Property — D C-11
- Identity Element — D C-14
- Basic Facts — M C-23
- Associative Property — D C-12
- Inverse Relation — 1 C-31
- Notation/Sub. - Add. — 1 C-28
- Addition/Subtraction — M C-13
- Def. of Meas. Length — D C-35
- Standard Units — D C-36
- Liquid Measure — D C-37
- Time Measure — D C-38
- Mass Measure — M C-39
- Temperature — D C-40
- Def. Of Multiplication — 1 C-24
- Multiplication — 1 C-25
- Comm. Prop./ Mult. — 1 C-15
- Ident. Elem. For Mult. — 1 C-16
- Zero Property — 1 C-17
- Definition of Division — 1 C-26
- Division — 1 C-27
- Fractions — D C-7
- Collections — M D-1
- Cardinal Numbers — M D-2
- Ordinal Numbers — M D-35
- Larger, Smaller — D D-39
- Sequencing Nos. — M D-40
- Place Value — D D-5
- Expanded Notation — D D-6
- Number Names — M D-4
- Order Property — M D-8
- Grouping property — M D-9
- Add. and Sub. — D D-16
- Inverse relations — D D-31
- Add. and Sub. — M D-32
- Open Sentences — 1 D-33
- Time — D D-28
- Calendar — D D-29
- Temperature — D D-30
- Money — M D-36
- Money — D D-37
- Cost of Items — M D-38
- Def. of Mult. — D D-10
- Def. of Div. — D D-11
- Products and Quotients — D D-20
- Mult. Order Prop. — D D-12
- Mult. Grouping Prop. — D D-13
- Mult. by 1 — D D-14
- Mult. by 0 — D D-15
- Missing Factors — D D-34
- Multiplication — 1 D-18
- Mult. by 10 and 100 — D D-17
- Division — D D-19

D1
- Fraction Models — D D-3
- Fraction Models — D D-7
- Large and Small Fract. — M D-41

D2
- Line Segments — M D-24
- Area — D-25
- Volume — D-26
- Volume — D D-27

D3
- Geom. Construction — D D-21
- Geom. Shapes — D D-22
- Geom. Properties — D D-23

LEVEL **B**

CLUSTER	1						2								3				4					
OBJECTIVE #	1	2	3	5	6	7	8	4	10	28	29	32	30	9	21	23	24	25	34	35	31	33	38	39
I,D,M	D	M	D	D	I	I	D	D	D	D	D	I	I	I	I	D	D	I	D	D	I	I	I	I
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PARTIAL CLASS RECORD MODEL